2.4.2. Scan Angle Limits

2.4.2.1. Purpose

The purpose of this test is to determine the scan angle limits of the radar and their effects upon the utility of the radar search volume.

2.4.2.2. General

Most air-to-ground radars operate in a single bar, raster scan format and often have several operator selectable antenna scan angle limits. The largest selection is usually bounded by the physical scan angle limits of the antenna. The bounds are often set by the physical limits of the antenna against the nose cone faring covering the antenna or even by line of sight interference between the radar beam and airplane structures. In addition, when extremely wide limits are used, the time that the antenna can spend at any specific bearing within the search volume is reduced for a given display update rate. When a lower scan angle limit selection is made in order to concentrate the search volume, the operator is often able to slew the center of the search volume within these maximum left and right limits. For these reasons, the maximum scan angle limits become critical and should be measured.

The maximum limits should be evaluated while performing radar navigation to ensure enough area is displayed to allow orientation on a tactical chart and during searches for targets of opportunity to ensure enough volume is searched such that the radar does not limit the airplane in its area of attack. During attacks, the maximum angle off the nose to the target expected in mission relatable tactics must be used to evaluate the scan angle limits while using the smaller angle selections. The smaller selections are used after the initial position of the target is determined to allow concentrating the radar on the target area and the intended flight path. The range and number of selections must be suitable for the expected scenarios for which the airplane is designed to operate.

2.4.2.3. Instrumentation

Data cards are required for this test with an optional voice recorder.

2.4.2.4. Data Required

Record the heading of the test airplane with a target of opportunity over the nose and just at the edge of the display for each scan angle setting for both the left and right limit. Record qualitative comments concerning the utility of the maximum scan angle limit and the smaller angle selections.

2.4.2.5. Procedure

Choose a target of opportunity at least 15 nm ahead of the test airplane to allow the test turn to be completed without significantly affecting the geometry of the target. If the display is truncated at the scan angle limit selected, the range must be inside of the truncated area. Place the target just to the right or left of the nose of the test airplane with the sweep centered on the nose. Turn the test airplane slowly toward the target, marking the test airplane heading as the nose crosses the target bearing and as the target passes off of the radar display. Repeat to the other side and for all scan angle limit selections. Qualitatively evaluate the effect of the maximum scan angle limit upon the utility of the radar map display for orientation on a tactical map, for the radar's utility in finding targets of opportunity over a wide area and for any constraints that the limit may pose upon attack tactics by restricting the maximum angle off of the nose during ingress to the target. Assess the utility of the smaller angle limits for concentrating the radar on a narrower area as the target position and the flight path to it are narrowed.

2.4.2.6. Data Analysis and Presentation

Subtract the test airplane heading while the target is over the test airplane nose from the heading as contact is lost for the left/right at each scan angle limit setting to determine the measured scan angle limits. Use the measured limits as supporting data where deficiencies are noted in the qualitative evaluation of the scan angle limits. Relate problems noted with the maximum scan angle limits to the utility of the map display for area orientation, finding targets of opportunity and to the limitations imposed upon inbound tactics by the maximum angle off the nose to the target that can be used while still illuminating the target. Relate the number and limits of the smaller angle selections to the

desirability of narrowing the scan volume as the target position is refined.

2.4.2.7. Data Cards

A sample data card is presented as card 25.

CARD NUMBER ___ TIME ___ PRIORITY L/M/H

AIR-TO-GROUND SCAN ANGLE LIMITS

[CHOOSE A TARGET OF OPPORTUNITY JUST TO THE LEFT OR RIGHT OF THE NOSE AT 15 NM. TURN TOWARDS THE TARGET. RECORD THE TEST A/C HEADING AS THE TARGET PASSES THROUGH THE NOSE AND WHEN IT IS LOST FROM THE DISPLAY DURING THE TEST AIRPLANE TURN. REPEAT TO THE OTHER SIDE AND FOR EACH SCAN ANGLE LIMIT SELECTION.]

RADAR MODE	AZ LIMIT SELECTION	NOSE	LEFT/RIGHT (L/R)	LOST TARGET

[RECORD QUALITATIVE COMMENTS CONCERNING THE UTILITY OF THE MAXIMUM SCAN ANGLE FOR RADAR MAPPING AND ORIENTATION, ITS EFFECT UPON TACTICS (MAXIMUM ANGLE OFF OF TARGET) AND FINDING TARGETS OF OPPORTUNITY. RECORD COMMENTS ON THE UTILITY OF THE RANGE AND NUMBER OF THE SMALLER SELECTIONS.]

SCAN ANGLE LIMIT SELECTION_____

TARGET RELATIVE BEARING_____

TYPE OF ATTACK_____

EFFECTS:

Card 25: Air-to-Ground Scan Angle Limits Data Card